First evidence of Late Permian alkaline magmatism at the edge of the Sahara Platform (north of the West African Craton) : geochronological/geochemical data and geodynamic significance

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Numerous mafic dykes, sills and laccoliths of lamprophyric dolerites and camptonites with minor gabbros and syeno-diorites crop out in the southern part of the Late Devonian-Early Carboniferous Tafilalt Basin (Eastern Anti-Atlas belt, Morocco). These rocks intrude the mildly folded Paleozoic series (from Ordovician to Early Carboniferous). Geochemically, the Tafilalt magmatism shows sodic-alkaline affinity, being produced by low degrees of partial melting from a metasomatized deep mantle source within the garnet stability field. Biotite $^{40}Ar/^{39}Ar$ and zircon $^{206}Pb/^{238}U$ dating of gabbros and syeno-diorite provide the first robust geochronological evidence of the age of the South Tafilalt magmatism. Results of $^{40}Ar/^{39}Ar$ dating of biotite give plateau ages of 264.16 ± 2.72 Ma, 262.61 ± 4.5 Ma and 259.04 ± 6.31 Ma, whereas $^{206}Pb/^{238}U$ dating of zircon yields a mean age of 255 ± 3 Ma. These ages coincide within the dating error, and indicate that this magmatism occurred during the Late Permian. Our U-Pb and Ar-Ar results demonstrate for the first time the occurrence of a Late Permian alkaline magmatism at the edge of the Sahara Platform where only Central Atlantic Magmatic Province (CAMP) intrusions were known.

The geochemistry of the Tafilalt magmatism is similar to the lamprophyres of the same age and other alkaline dolerites and lamprophyres of Triassic age emplaced in central Pangea in both sides of the Atlantic Ocean (i.e., Morocco, south-western Europe and eastern North America). These rocks, including the Tafilalt ones, would reflect an early-rift magmatic activity that preceded the Triassic rifting heralded by the CAMP. This magmatic activity is recorded in both sides of the future Atlantic Ocean by small-volume alkaline magmatism that started in the Late Permian and extends into the Triassic. The alkaline magmas are probably generated in response to an increase in the mantle potential temperature (global mantle warming) underneath the Pangea supercontinent. This precursory magmatism was controlled locally by the extensional/transtensional reactivation of zones of crustal weakness located at the junction between two branches of the Variscan Orogen, i.e., the ENE-trending Anti-Atlas Belt and the NW-trending Ougarta Belt.

Keywords : Gondwana margin; Late Permian; Alkaline magmatism; Pangea supercontinent; Morocco.